Eco-Toxicology and Control of Indian Desert Gerbil, *Meriones hurrianae* (Jerdon)

IX. Ecological Distribution in the Rajasthan Desert

BY

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(*With a map and a plate*)

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The Indian Desert Gerbil, *Meriones hurrianae* (Jerdon) is the most abundant rodent in the Rajasthan desert. It occurs in sandy, gravelly and ruderal habitats, but shows a preference for the first one. It appears that it is more commonly found in grasslands having *Aristida* spp. as the chief component. Among the crop fields, the frequency of desert gerbil is highest in cotton-wheat fields among irrigated crops, and in the *bajra* fields among rain-fed crops. In most of the Rajasthan desert it is associated with *Gerbillus gleadowi* but in districts receiving comparatively higher rainfall, *Tatera indica* and *Rattus meltada pallidior* also occur with it. The relative abundance of *M. hurrianae* in various regions of the Rajasthan desert and its frequency in different vegetational communities are discussed.

INTRODUCTION

On the basis of extensive trapping, attempts have been made to discuss the distribution of the Indian Desert Gerbil, *Meriones hurrianae* (Jerdon) in Rajasthan desert with reference to various habitat and vegetation types, its relative abundance and its interactions with other rodents. It has been observed that the merion gerbil occurs in a variety of habitats and vegetation types, and is the most abundant rodent of this desert.

METHODS

The Indian Desert Gerbil, *Meriones hurrianae* (Jerdon) was collected at one locality in each of the eleven administrative districts of the Rajasthan desert. At each locality trapping was carried out in four habitats, namely, sandy, rocky, gravel plains and ruderal (villagecomplex).

In each habitat, two trap lines, containing 30 snap traps in each line at an interval of 10 metres, were fixed in a homogenous vegetational community. The two trap lines were 15 metres apart from each other and were run for 72 hours. Snap traps were baited with peanut butter. The frequency of *M. hurrianae* is expressed as the percentage of total number of rodents collected in a habitat and in a locality. Observations on their ecological distribution were also made in the field.

Observations and Discussion

Ecological distribution :

Among the Indian Desert Gerbil, *Meriones hurrianae* (Jerdon) collected during the survey, 60 per cent were from sandy habitat, 17 per cent from gravel plains, and 23 per cent from the ruderal habitat. No merion gerbil occurred in the rocky habitat. This analysis suggests that the rodent shows a habitat preference for the sandy environment.

Sandy habitat : In the sandy habitat, *M. hurrianae* inhabits a variety of sub-habitats. It mostly occurs on the sandy plains and in the interdunal regions. It does not occur on the undulating mobile sand dunes. On the sandy plains as well, it prefers hummocky landscape, which is formed due to a higher density of bushes like *Capparis decidua, Calligonum polygonoides* and *Zizyphus nummularia*. The drifting sand, blown by the strong desert winds, piles around the bushes, giving a hummocky look to the topography. The desert gerbil concentrates its burrows over the hummocks and around it (photograph 1). This type of denning behaviour puts gerbils in an advantageous position, especially in the summer season since due to the presence of extensive root system of the bushes, a higher humidity is maintained in the soil surrounding it, and in their burrows also thus enabling them to withstand the desert temperatures comfortably. This micro-climate, higher relative humidity and low temperature (Prakash *et al.* 1965) in the burrows also assist them in maintaining a balanced state of homoestasis.

During the rainy season, the sand dunes are temporarily stabilised and the rodents move to these dunes from the interdunal regions, mainly for foraging since a wide variety of vegetation sprouts on them. At Bikaner, it has been observed that the dunes were completely colonised by the desert gerbils and the spacing in between their burrow openings was even less than half a metre. Excavation of their burrows revealed that, on the temporarily fixed dunes, they do not dig extensive burrow systems but thrive in straight tunnels, from a metre to three metres long. These rainy-season-tunnels do not penetrate deep into the soil and are only 5 to 10 cm deep.

In the Sri Ganganagar district, the landscape of most parts of this district has changed from undulating sandy plains to flat, irrigated crop

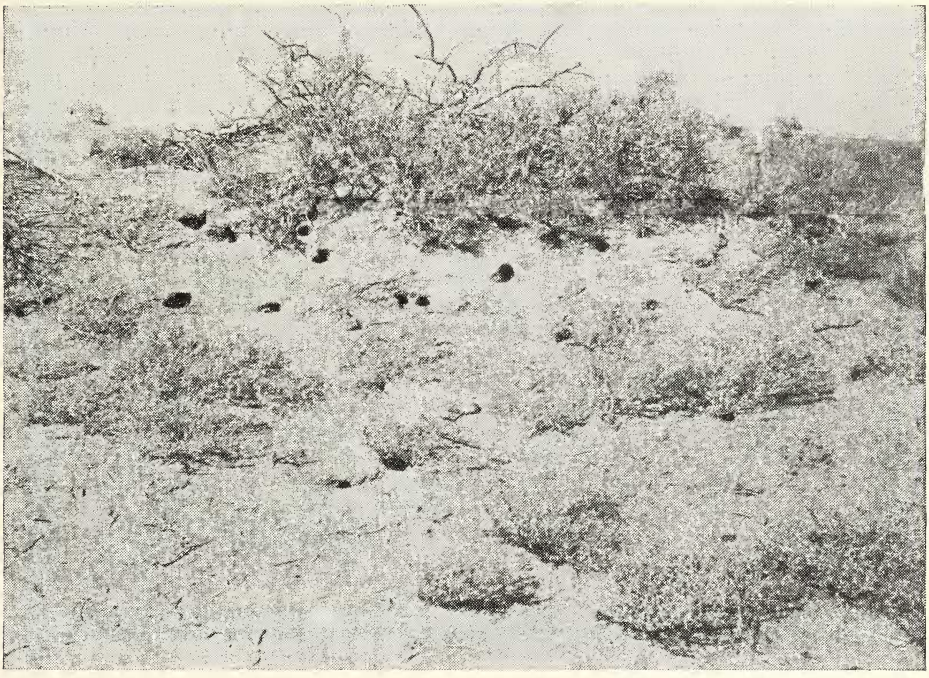
fields during the last 40 years, after the advent of the Ganga Canal. The desert gerbils were as prolific in this district in the pre-canal period, as they are now in any other sandy plain of the Rajasthan desert (Prakash 1958). The numbers of the desert gerbil have now been drastically reduced indirectly due to the influence of the present day land use pattern. Now, *M. hurrianae* occurs near crop fields on uplands where patches of sandy soil are distinct. Throughout the crop fields, where the soil is clayey and consolidated, desert gerbils are not found and they are replaced by *Nesokia indica*, *Tatera indica indica* and *Rattus meltada pallidior*. Taber *et al.* (1967) have also observed that the desert gerbil was once much more commonly distributed through the Lyallpur region in Pakistan. Land levelling for irrigation destroyed the interspersion of dry mounds for burrowing and moist depressions for feeding. Consequently, their numbers have also reduced in Lyallpur over the past century due to the introduction of irrigation.

At certain localities in the desert, the drifting of the sand dunes is checked by hillocks and a huge amount of sand is deposited at the foot of the hill (Barmer, Jodhpur, Jaisalmer and Jhunjhunu districts). At times, such deposits reach 250 to 350 metres above the hillocks. When the sand accumulation is fresh, unstabilised, and is composed of loose soil *Gerbillus gleadowi* migrate to it but as gradually the soil stabilises, *G. gleadowi* are more or less replaced by *M. hurrianae*.

Included in the sandy habitat, we find the desert gerbils in the salt plains near Sambhar Lake, Pachbhadra and Didwana regions. Their burrows are found even in the salt pits, indicating that they can tolerate a high level of salt in the soil without any apparent effect. The desert gerbils in the Pachbhadra salt region, however, look paler than those found in other localities and the hairy tuft at the tip of their tail is brownish-sandy in colour instead of the usual black colour.

Gravelly habitat : There are two chief types of gravel plains found in the Rajasthan desert, one is composed of hard rock pebbles (Jaisalmer-Barmer district) and the other type is chiefly due to a large number of calcium carbonate concretions which are formed due to upward movement of calcium carbonate, by leaching of soil (Nagaur, northern Jodhpur, and Jhunjhunu districts). The desert gerbils do not occur in the first type of gravel plain but commonly occur in the latter, usually in depressions where the grasses and other vegetation grow which provide forage for them.

Ruderal habitat : Our definition of the ruderal habitat includes rather a number of sub-habitats which are influenced by man. Certain villages, and the micro-villages, locally known as ' Dhani ', are situated over sand dunes. The Hairy-footed Gerbil, *Gerbillus gleadowi* is the most common rodent around them but *M. hurrianae* occurs in the mud-



1. Desert Gerbils concentrate their burrows over the hummocks surrounding the bushes (*Calligonum polygonoides* in this photograph)

2. Burrow openings of *M. hurrianae* in association of the cucurbit *Citrullus colocynthis* (*Photos : Ishwar Prakash*)

thorn clad, fences of the dhani or a house. These gerbils do not actually enter the houses which are inhabited by *Rattus rattus* and *Mus musculus* but occur in the backyard, cattle sheds etc. Whether these gerbils thrive on the natural vegetation or depend on man for food is not known precisely.

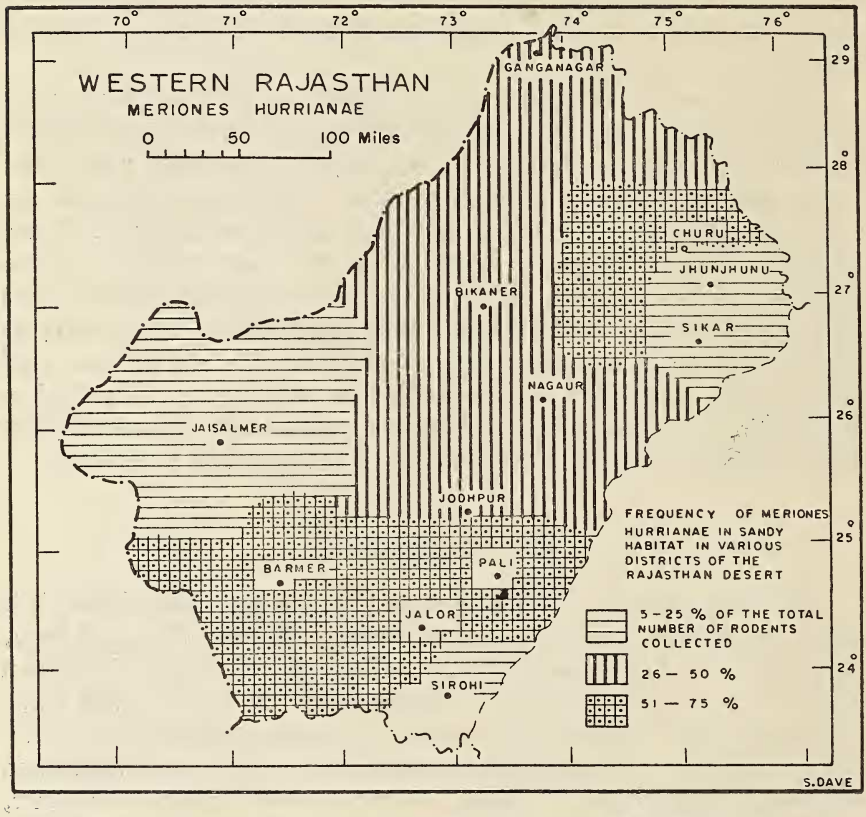
Prior to pre-monsoon showers, the fields are ploughed for sowing the *kharif* crops. Due to ploughing activity, burrows of desert gerbils are destroyed and they migrate to the fringes of the fields where they re-establish themselves in shallow burrows. Soon after the crops are harvested, two types of their distributional patterns are observed. Some immigrate into the harvested fields and quite a large number colonise the small patches where the crop is stacked (Photograph 2) and the places where crop grains are being threshed from ears. I have seen as many as 40 desert gerbils in an area of 15 sq metres, foraging on the harvested crops. They also inflict severe damage to standing crops by feeding upon entire plants in early stages of growth and later by cutting the plant and then feeding upon the ripe seeds, both in *kharif* and *rabi* crops.

Relative abundance

While *M. hurrianae* is distributed all over the Rajasthan desert, it is more abundant in the sandy habitat at Jodhpur, Barmer, Nagaur, Churu, Jhunjhunu and Sikar districts (Map). The map of western Rajasthan shows their relative abundance, the frequency of *M. hurrianae* being calculated as per cent of total number of rodents collected in the trap lines in 72 hours. The relative abundance of the desert gerbil appears to be associated with the soil types. In the western districts (Jaisalmer, Bikaner and part of Barmer), the topography is dominated by drifting sand dunes and a lower number of desert gerbils frequent there. In the northern district of Sri Ganganagar, their frequency is low due to the altered land use pattern due to irrigation cropping. In the south-eastern districts of Pali and northern Sirohi, the soil is too clayey and here their numbers are low. In one of our earlier communications (Prakash *et al.* 1971), we had stated, on the basis of quantitative data, that *M. hurrianae* numbers and the clay per cent in soil are inversely proportional. But in the central and south-eastern districts the soil is ' Red-desertic ' type (Roy & Sen 1968) and considering their abundance in this region it appears that this soil type is most suitable for them.

Relative abundance in relation to vegetation : Table 1 summarises various vegetational communities in which rodent trapping was done in different habitats, per cent basal cover of vegetation, and the frequency of *M. hurrianae* as per cent of the total number of rodents collected. It is evident that the desert gerbils are found in almost every vegetation

type due to their versatility to adapt to a wide variety of food (Prakash 1962, 1969). It appears from the table that gerbils are more common in



Distribution and relative abundance of *M. hurrianae* in Rajasthan

communities having *Aristida* spp. as a dominant grass. Earlier we had observed (Prakash *et al.* 1971) that at six localities in the three bio-climatic zones of the Rajasthan desert the largest number of this gerbil was associated with the grass *Aristida*. It has also been found that the desert gerbils shift their burrows near the creeper, *Citrullus colocynthis*, when it fruits. A burrow opening can be found near and under every fruit (Photograph 3). The fruit is scooped and seeds eaten right from the burrow, without exposing the rodent to climatic and predatory hazards. *M. hurrianae* shuns localities where an abundance of grasses like *Cenchrus biflorus* and *Erianthus munja* grow. The ripe inflorescence of *C. biflorus* is very spiny, which sticks to their body and makes life difficult for the gerbils (Prakash 1964). In the 100 mm rainfall region in the extreme west of Jaisalmer district, *M. hurrianae* were found to be associated with the perennial bush, *Haloxylon salicornicum*. Association of this rodent with this bush has also been observed in North Africa by Petter (1961).

Relative abundance in relation of basal cover of vegetation : It is evident that basal cover of the vegetation does not influence the relative

TABLE 1

PER CENT BASAL COVER IN DIFFERENT VEGETATION COMMUNITIES AND RELATIVE ABUNDANCE OF *M. hurrianae* IN SANDY HABITAT

Chief vegetation community	% Basal cover of vegetation	Percent frequency of *M. hurrianae*
Tephrosia purpurea—Aerva pseudo-tomentosa—Aristida spp. ..	0·1	53·3
Eleusine compressa—Cyperus arenarius—Calligonum polygonoides ..	3·2	27·2
Lasiurus sindicus—Cenchrus biflorus—Blepheris sindicum ..	6·9	25·0
Cyperus arenarius—Aristida spp.—*Crotalaria burhia*..	1·0	24·2
Cyperus arenarius—Cenchrus biflorus—Crotalaria burhia ..	1·3	75·0
Pulicaria wightiana—Sesbania aegyptiaca—Aristida spp. ..	8·9	35·5
Sporobolus helvolus—Desmostachya bipinnata—Acacia jacquemontii ..	6·2	54·5
Panicum turgidum—Eleusine compressa—Dactyloctenium scindicum ..	0·8	75·0
Dichanthium annulatum—Eremopogon faveolatus—Aristida spp. ..	7·3	present
Cenchrus setigerus—Eleusine compressa—Aristida spp.	1·0	25·0
Zizyphus nummularia—Cenchrus biflorus—Aristida spp.	3·4	28·9
Gram field ..	—	20·0
Cotton-wheat field ..	—	57·1
Bajra-chilli field ..	—	44·5

numbers of the desert gerbils (Table 1). Seventy-five per cent of the rodents trapped were *M. hurrianae* where the basal cover was only 1·3 and 0·8 per cent respectively, whereas in vegetational communities where the basal cover was high, 7·3, 3·4 and 3·2 per cent, the relative abundance of desert gerbils was not more than 27·2 per cent (Table 1). But in the *Sporobolus-Desmostachya-Acacia* community, where the basal cover was comparatively high (6·2 per cent), the frequency of merion gerbils was also high (54·5 per cent). These findings indicate that the basal cover of vegetation and the frequency of desert gerbils do not have any definite and apparent relationship.

RODENT ASSOCIATES

In the western districts of the desert, *M. hurrianae* is associated with the Hairy-footed gerbil, *Gerbillus gleadowi* and Wagner's Gerbil, *G. nanus indus* (Table 2). In some of the districts, *Rattus gleadowi* and *Mus platythrix sadhu* are also found along with *M. hurrianae*. In the south-